

TSG/ESD/TEB-31/70
28 September 1970

MEMORANDUM FOR: Chief, Research & Engineering Division, TSG

THROUGH : Chief, Test & Evaluation Branch, ESD/TSG
Chief, Engineering Support Division, TSG

SUBJECT : Memorandum Test Report on Twin Stage Comparator (TSC)
Modification

1. Modifications

The following TSC modifications were made by the [REDACTED] Company on 15-16 September 1970:

25X1

a) Hand wheel stage controls were added for fine coordinate adjustment.

b) The thick pressure plate frames were removed and thinner frames installed.

c) An adjustment of the objective lens fine-focus control was made on both stages.

2. Preliminary Performance Comparison

2.1 Hand Wheel Operation

A brief evaluation of the hand wheel controls shows a significant improvement in ease of pointing and pointing ability.

2.1.1 Ease of Pointing

Thirty timed pointing measurements of 4 consecutive target points (approximately forming a square) were made first using only the joystick for stage movement, then using only the hand wheel controls. Average time using the joystick was 111.3 sec. and the average time using only the hand wheels was 80.4 sec. for an improvement of 27.7% with the hand wheels.

2.1.2 Pointing Ability

The repeatability of pointing coordinate readings was checked simultaneously with the timed measurements by recording and comparing coordinate read-outs, first using only the joystick and then only the hand wheels. The comparison shows the percentage of points within a 2 micron radius centered on the average value of the 30 pointings.

Percentage of Point Readings Inside a Two Micron Radius

	<u>Joystick</u>	<u>Hand Wheels</u>
Point Number 0	22/30 = 73.3%	21/30 = 70.0%
1	11/30 = 36.7%	24/30 = 80.0%
2	21/30 = 70.0%	24/30 = 80.0%
3	16/30 = 53.3%	26/30 = 86.7%
Totals	70/120 = 58.3%	95/120 = 79.2%
Improvement with hand wheels - 20.8%		

2.2 Pressure Plate Frames

The thin pressure plate frames easily clear the objective lens turrets now, eliminating possible lens damage. The frames are no longer hinged to the stage and therefore film chips are inserted with some slight difficulty. A small handle on each frame might facilitate film loading.

2.3 Fine Focus Control

The fine-focus control on both stages was improved, but the right stage 1.3X objective still cannot reach focus before the adjustment reaches the upper limit of movement.

2.4 Resolution

A post-modification check of the resolution was made to insure the performance remained unchanged. Resolution of the left optical path was unchanged within the physical limits of reading resolution target elements of +1 element. Right path resolution which was below specification previously, apparently has degraded further. The target used was the 1951 USAF Resolution Target, 240X Reduction. Data taken by two observers was averaged to the nearest element. (See Attachment, Resolution Data Comparison.)

3. Further Evaluation and Testing

Other items requiring further consideration include the following:

a) Film Platen & Holddown System - The system needs to be tested to insure in-focus conditions are maintained over stage format.

b) Measurement Accuracy - The joystick and hand wheel controls need to be checked for possible back-lash problems

c) Orthogonality - Testing must be done to insure X-Y orthogonality remains within the specified 5 seconds of arc.

4. Recommendations

As the right optical path resolution and fine focus remain below specifications the [REDACTED] should be required to correct these deficiencies.

[REDACTED]
Test Engineer
ESD/TEB

Attachment:
as stated

Distribution:

Original - Addressee

- 1 - NPIC/TSG/RED [REDACTED]
- 1 - NPIC/TSG/PPS (through Ch/TSG)
- 1 - NPIC/IEG/OD [REDACTED]
- 1 - DDI/IAS [REDACTED]
- 1 - DIAAP-9 [REDACTED]
- 1 - ARMY/SPAD [REDACTED]
- 3 - NPIC/TSG/ESD/TEB

NPIC/TSG/ESD/TEB: [REDACTED] (28 Sept 70)

Eyepiece	Objective	Zoom	System Power	Resolution (Lines/mm)			
				Left		Right	
				Before	After	Before	After
6X	1.3	1	7.8	67.44	- 60.0	67.44	67.44
		1.5	11.7	87.96	- 75.6	87.96	87.96
		2	15.6	134.60	- 95.28	120.0	- 95.28
		3	18	134.60	134.6	134.6	+ 169.68
		1.5	27	169.68	+ 190.56	190.96	- 169.68
		2	36	213.84	213.84	213.84	- 190.56
	6	1	36	268.8	268.8	268.8	268.8
		1.5	54	427.2	- 381.6	338.4	- 302.4
		2	72	480.0	480.0	427.2	- 381.6
		10	60	480.0	480.0	480.0	- 427.2
		1.5	90	604.8	- 537.6	537.6	- 480.0
		2	120	679.2	679.2	604.8	- 537.6
10X	1.3	1	13	95.28	- 87.96	95.28	- 75.60
		1.5	19.5	120.0	+ 134.6	106.80	- 87.96
		2	26	120.0	+ 134.6	120.0	- 95.28
		3	30	213.84	213.84	213.84	- 190.56
		1.5	45	240.0	240.0	240.0	- 190.56
		2	60	268.8	272* 268.8	240.0	272*- 213.84
	6	1	60	427.2	- 338.4	338.4	- 302.4
		1.5	90	480.0	480.0	480.0	- 381.6
		2	120	537.6	535* 537.6	480.0	535*- 427.2
		10	100	604.8	604.8	604.8	- 480.0
		1.5	150	760.8	- 679.2	679.2	- 537.6
		2	200	854.4	850* -760.8	760.8	850*- 604.8

* These values represent 85% of the Stereoviewer resolution before optical path extension by the [] and are the contracted specifications for the instrument.